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The genera *Myonera*, *Octoporia*, and *Protocuspidaria* (Pelecypoda, Cuspidariidae) from deep waters of Campos Basin, Rio de Janeiro, Brazil with descriptions of two new species

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Abstract: Eight species of Cuspidariidae belonging to the genera *Myonera* Dall, 1886, *Octoporia* Scarlato and Starobogatov, 1983, and *Protocuspidaria* Allen and Morgan, 1981 were obtained in samples from the continental slope (700-2000 m depth) at Campos Basin, Rio de Janeiro state (22°S), Brazil. *Myonera paucistriata* Dall, 1886 and *Protocuspidaria verityi* Allen and Morgan, 1981 are now documented from the Campos Basin. Though previously reported for Brazil, the known range of *Octoporia octaporosa* (Allen and Morgan, 1981) is enlarged southward. *Myonera limatula* (Dall, 1881) and *Protocuspidaria atlantica* Allen and Morgan, 1981 are reported from the South Atlantic Ocean for the first time. *Myonera kaiwa* sp. nov. and *Protocuspidaria jarauara* sp. nov. are described herein. *Myonera* sp., an eighth taxon, is present as one unique specimen. The presence of micro-pits on the shell surface is reported for the first time in the Septibranchia.

Key words: Mollusca, Anomalodesmata, biodiversity, continental slope, micro-pits

The septibranchs comprise some of the most intriguing pelecypods, with anatomical adaptations for a carnivorous diet. Reflecting the importance of the group in deep waters, in the last 30 years the number of described species has increased considerably, with many faunal surveys and taxonomic reviews (Kuroda 1952, Bernard 1974, Knudsen 1982, Poutiers 1984, Poutiers and Bernard 1995). In spite of this activity, there are still only a few studies regarding exclusively the septibranchs in deep waters off Brazil (*e.g.*, Marini 1974).

The classification of septibranchs has a long taxonomic history (Pelseneer 1911, Thiele 1935, Newell 1969, Allen and Morgan 1981, Morton 1981, Scarlato and Starobogatov 1983, Poutiers and Bernard 1995, Harper *et al.* 2006). Scarlato and Starobogatov (1983) proposed a new classification based on the branchial apparatus-septum structure that increased the number of higher-rank taxa, many of them new. Poutiers and Bernard (1995) completed a revision of species from the Pacific Ocean, and their classification disagreed with that of Scarlato and Starobogatov (1983). Harper *et al.* (2000) and Morton (2003: 378, table 3), both based on morphological data, did not recognize the higher-rank taxa classification proposed by Scarlato and Starobogatov (1983). Additionally, Dreyer *et al.* (2003) and Harper *et al.* (2006) addressed the same issue, but worked with all anomalodesmatans, and with molecular tools as well, also did not support Scarlato and Starobogatov (1983).

In our opinion, there is insufficient justification to adopt the higher-rank taxa proposed by Scarlato and Starobogatov (1983) and we follow the classification of Poutiers and Bernard (1995), regarding *Myonera* Dall, 1886, *Octoporia* Scarlato and Starobogatov, 1983, and *Protocuspidaria* Allen and Morgan, 1981 as full genera of Cuspidariidae.

MATERIALS AND METHODS

All material was dredged with a 0.25-m^2 box-corer, from the continental slope off Rio de Janeiro state, at depths ranging from 700 to 1950 m. The dredging was carried out by the R/V *Astro-Garoupa* between 2001 and 2003 as part of the program "Environmental Characterization of Campos Basin, RJ, Brazil" under the auspices of PETROBRAS S.A.

Each sample was washed through a mesh of 0.05 mm and preserved in 70% ethanol. In the laboratory, the residues were examined under magnification and the molluscs picked out. Although no live specimens were collected, many of the shells were in a good state of preservation.

Shells were mounted on specimen stubs and photographed under a Scanning Electron Microscope (ZEISS EVO 40), at the Gerência de Bioestatigrafia e Paleoecologia Aplicada (BPA), belonging to the Petrobras Research Center (Centro de Pesquisas da Petrobras–CENPES). The diameters of the micro-pits were measured on the SEM photos.

Though other authors have given the distribution of species studied herein, only those who expanded the known geographic range of these species were included in the tables of distribution.

The material is deposited in the Mollusca collection of the following institutions: Departamento de Zoologia, Instituto

de Biologia, Universidade Federal do Rio de Janeiro (IBUFRJ); Museu de Zoologia, Universidade de São Paulo (MZUSP); Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ); and Muséum national d'Histoire naturelle, Paris (MNHN).

RESULTS

Cuspidariidae Dall, 1886
Genus *Myonera* Dall, 1886
Type species: *Myonera paucistriata* Dall, 1886 by original designation in Dall, 1886b

Genus characterization

Shell small, outline variable, inequilateral, rostrate, usually inflated. Externally with concentric and/or radial ornamentation. Hinge edentulous. Ligament internal, deflected and posteriorly pointed. Gills with four or five pairs of pores. (Adapted from Allen and Morgan 1981, Poutiers and Bernard 1995).

Myonera paucistriata Dall, 1886 (Figs. 1A-D)
Neaera paucistriata Bush, 1885: 473 [*nomen nudum*]
Myonera paucistriata Dall, 1886: 302; Abbott 1974: 568; Allen and Morgan 1981: 473; Rios 1994: 303
Cuspidaria paucistriata: Pelseneer, 1911: 80

Characterization

Shell white, small (max. length 8 mm), elongated, inequilateral, rostrate, inflated. Umbo large, centralized, rostrum short, ventrally pointed, two keels between umbo and postero-ventral margin, anterior margin rounded. Anteriorly with an undulating appearance. External surface smooth. Micro-pits absent. Hinge edentulous. Resilifer posteriorly pointed.

Distribution of *Myonera paucistriata* Dall, 1886

References	Locality	Depth (m)
Dall (1886b)	Type locality: U. S. Coast Survey Steamer 'Blake' sta. 226 and 230 [St. Vicent]; sta. 43 [near Tortugas, Florida].	620-849
Abbott (1974)	North Carolina to West Indies.	353-1609
Allen and Morgan (1981)	Pacific Ocean: Hawaiian Islands. Atlantic Ocean: northwest Atlantic, west coast of Malabar, Bay of Biscay.	678-3806
Rios (1994)	North Carolina to West Indies. Brazil.	600-760
Rosenberg (2005)	USA: Florida: Florida Keys. 35°N to 34.42°S; 80°W to 4.25°W.	166-1609
Present study	Campos Basin, Rio de Janeiro, Brazil.	1050-1930

Discussion

The name *Myonera* was introduced as a subgenus of *Neaera* by Dall (1886a). Later, Dall (1886b) established *Myonera* as a genus and included *Neaera sulcifera* Jeffreys, 1881, *Neaera angularis* Jeffreys, 1876, *Neaera lamellifera* Dall, 1881, *Neaera limatula* Dall, 1881 [plus its synonym *Neaera contracta* Jeffreys, 1881], *Myonera laticella* Dall, 1886, *Neaera undata* Verrill, 1884, and *Neaera fragilissima* Smith, 1885, and designated *Myonera paucistriata* as the type species. Currently, some of these species are allocated to other genera (*e.g.*, *Cuspidaria sulcifera*, *Cuspidaria contracta*, *Cuspidaria undata*, *Cardiomya fragilissima*).

Some classifications still rank *Myonera* as a subgenus of *Cuspidaria* (Thiele 1935, Allen and Morgan 1981), as a section of the genus *Cuspidaria* (Fischer 1887) or, most frequently, as a genus of the family Cuspidariidae (Grassé 1960, Vokes 1967, Bernard 1974, Rios 1994, Poutiers and Bernard 1995, Absalão *et al.* 2003).

Scarlato and Starobogatov (1983) proposed the family Myoneridae, comprising 11 genera, a classification not followed by many authors (Rios 1994, Poutiers and Bernard 1995, Harper *et al.* 2000, 2006, Morton 2003, Dreyer *et al.* 2003). We agree with Poutiers and Bernard (1995: 139) that "although the usage of several ordinal taxa [...] may prove to be useful, many of them seem presently unwarranted."

Material examined

IBUFRJ 17855 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.01, [1 valve], IBUFRJ 17860 (22°07′17″S, 39°50′02″W, 1230 m), 13.V.02, [2 valves], IBUFRJ 17865 (22°04′52″S, 39°49′04″W, 1330 m), 09.V.02, [2 valves], IBUFRJ 17866 (22°02′36″S, 39°49′36″W, 1330 m), 08.V.02, [1 valve], IBUFRJ 17867 (22°03′27″S, 39°45′07″W, 1730 m), 08.V.02, [2 valves], IBUFRJ 17871 (22°05′45″S, 39°45′55″W, 1730 m), 09.V.02, [1 valve], IBUFRJ 17880 (22°09′10″S, 39°44′50″W, 1930 m), 08.V.02, [1 valve], IBUFRJ 17911 (22°04′44″S, 39°46′31″W, 1650 m), 24.XI.02, [2 valves], IBUFRJ 17912 (21°57′15″S, 39°47′43″W, 1650 m), 14.XII.02, [1 valve], IBUFRJ 17924 (21°52′41″S, 39°46′17″W, 1650 m), 11.XII.02, [1 valve], IBUFRJ 17925 (22°41′10″S, 40°02′20″W, 1650 m), 13.VI.03, [3 valves], IBUFRJ 17935 (21°52′41″S, 39°46′17″W, 1650 m), 26.VI.03, [1 valve], IBUFRJ 17936 (21°57′15″S, 39°47′41″W, 1650 m), 28.VI.03, [3 valves], IBUFRJ 17954 (22°04′45″S, 39°46′31″W, 1650 m), 27.VI.03, [4 valves], IBUFRJ 17979 (22°11′04″S, 39°47′04″W, 1650 m), 22.VI.03, [7 valves], IBUFRJ 18025 (21°57′15″S, 39°49′37″W, 1350 m), 25.VI.03, [6 valves], IBUFRJ 18026 (22°26′27″S, 39°58′51″W, 1050 m), 20.XI.02, [1 valve], IBUFRJ 18027 (21°57′15″S, 39°49′37″W, 1350 m), 14.XII.02, [2 valves], IBUFRJ 18030 (21°52′41″S, 39°46′17″W, 1650 m), 11.XII.02, [6 valves].

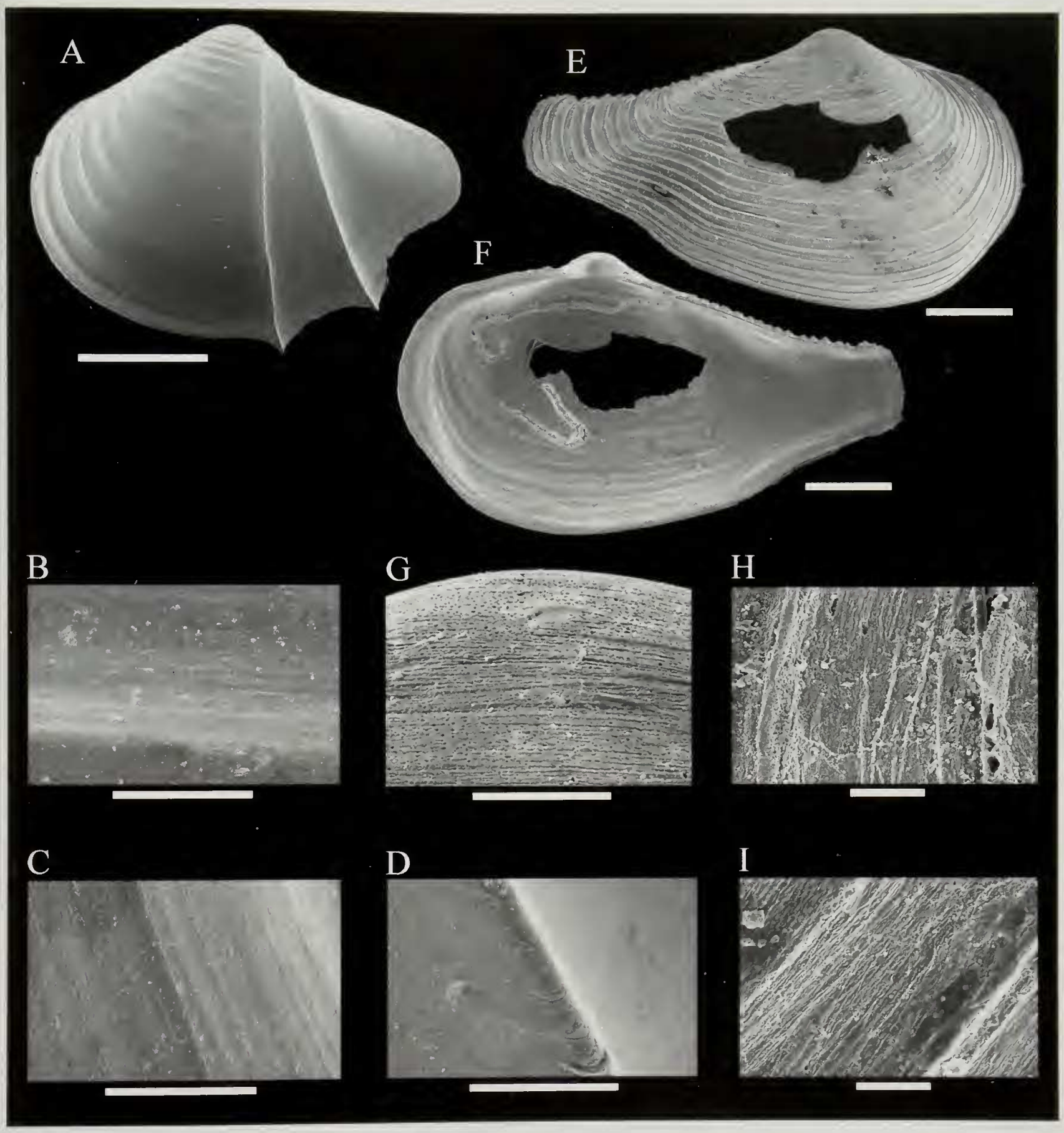

Figure 1. A-D, *Myonera paucistriata* Dall, 1886. IBUFRJ 17924. A, external view; B, umbo detail; C, anterior margin detail; D, rostrum detail. E-I, *Myonera limatula* (Dall, 1881). IBUFRJ 14798. E, external view; F, internal view; G, umbo detail; H, rostrum detail; I, anterior margin detail. Scale bar A: 2 mm; E-F: 1 mm; B-D, G-I: 100 μm.

Discussion

The name *Neaera paucistriata* was first cited in Bush (1885), but in a manner that does not comply with articles 12 and 16 of the Code (ICZN 1999), characterizing it as a *nomen nudum*. A proper description of this species was made by Dall (1886b) as *Myonera paucistriata*.

This is probably the most common of all septibranchs (Allen and Morgan 1981). In Campos Basin, it was present in 18 of 117 stations where pelecypods occurred.

Regarding micro-pits, this species is different from all other *Myonera* in this study, because, for *Myonera paucistriata*, no micro-pits were observed on the shell surface (Figs. 1B-D).

Myonera limatula (Dall, 1881) (Figs. 1E-I)
Neaera limatula Dall, 1881: 112
Neaera contracta: Jeffreys, 1881: 941, pl. LXXI, fig. 4
Myonera limatula: Dall, 1886: 304, pl. III, fig. 5

Characterization

Shell white, small (max. length 6 mm), elongate, inequilateral, rostrate, somewhat inflated. Umbo large, closer to anterior end, rostrum oblique, pointing downwards, postero-ventral sinuation slightly pronounced, anterior margin rounded. Externally with about 20 equidistant concentric lamellae with fine concentric growth lines between them. Micro-pits present on umbo (size: $\bar{x} = 3$ µm ± 0.9 *SD*) and restricted to distal surface of concentric lamellae on the rostrum (size: $\bar{x} = 2$ µm ± 0.5 *SD*). These pits are unevenly distributed over the shell, being concentrated on the posterior part. Hinge edentulous. Resilifer somewhat oblique.

Distribution of *Myonera limatula* (Dall, 1881)

References	Locality	Depth (m)
Dall (1881)	Type locality: U. S. Coast Survey Steamer 'Blake' sta. 44 [near Tortugas, Florida].	985
Abbott (1974)	off Nantucket, Massachusetts, Florida Strait	985-1000
Poutiers and Bernard (1995)	Northwest and West Central Atlantic.	230-1000
Rosenberg (2005)	USA: Florida: West Florida. 42°N to 25°N.	985-1000
Present study	Campos Basin, Rio de Janeiro, Brazil.	1700

Material examined

IBUFRJ 14798 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 valve].

Discussion

The hinge plate of *Myonera limatula* has a lamellar process on the postero-dorsal margin of the right valve (Fig. 1F). This was not mentioned in the original description (Dall 1881: 112-113) but was noted for *Neaera contracta* (Jeffreys, 1881), a junior synonym of *M. limatula*. Jeffreys (1881: 941) noted one laminar tooth on the posterior side of the right valve, extending parallel to the hinge plate. Dall (1886b: 304) argued that the posterior margin of the right valve is beveled off and is not a tooth, and we agree with this interpretation.

Unlike *Myonera paucistriata*, micro-pits are present in *Myonera limatula*. These micro-pits are restricted to the umbo region (Fig. 1G) and on concentric lamellae, which shows a gradient of distribution of the micro-pits, being very abundant on the rostrum region (Fig. 1H) and vanishing towards the anterior and ventral margins (Fig. 1I). In Campos Basin it was present at 1 of 117 stations where pelecypods occurred.

Myonera sp. (Figs. 2A-E)

Description

Shell small (max. length 3 mm), fragile, inequilateral. Umbo slender, small, closer to anterior end, dorsal margin straight, rostrum long, postero-ventral sinuation absent, anterior margin rounded. Ornamented from anterior to posterior ends with seven equally spaced concentric continuous ridges, which are present from the middle to the ventral margin of the shell. Hardly visible concentric growth striae. Micro-pits (size: $\bar{x} = 3$ µm ± 0.5 *SD*) are abundant at umbo and less numerous at rostrum, but vanish toward antero-ventral margin and are absent from the ridges of shell. Hinge edentulous. Resilifer elongated, posteriorly pointed.

Distribution

Restricted to Campos Basin, Rio de Janeiro state, Brazil.

Material examined

IBUFRJ 14795 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 spec.].

Discussion

A very rare taxon, only one specimen was found. Although we strongly suspect that it is new to science, a formal epithet will be delayed until additional material is collected.

Myonera sp. can be distinguished from all other Atlantic species by a unique set of characters: the straight dorsal margin and the narrow length of the dorso-ventral axis, which is the smallest among the known Atlantic species. The most similar species in the South Atlantic is *Myonera alleni* Poutiers, 1995 (figured at Allen and Morgan 1981: 472, fig. 35 as *Myonera atlantica*). *Myonera* sp. can be distinguished from *M. alleni* by, in the former, the absence of postero-ventral sinuation and rostral ridge, antero-dorsal margin straight (Fig. 2A). Often *M. alleni* shows incomplete concentric ridges, whereas in *Myonera* sp. these are always complete from the

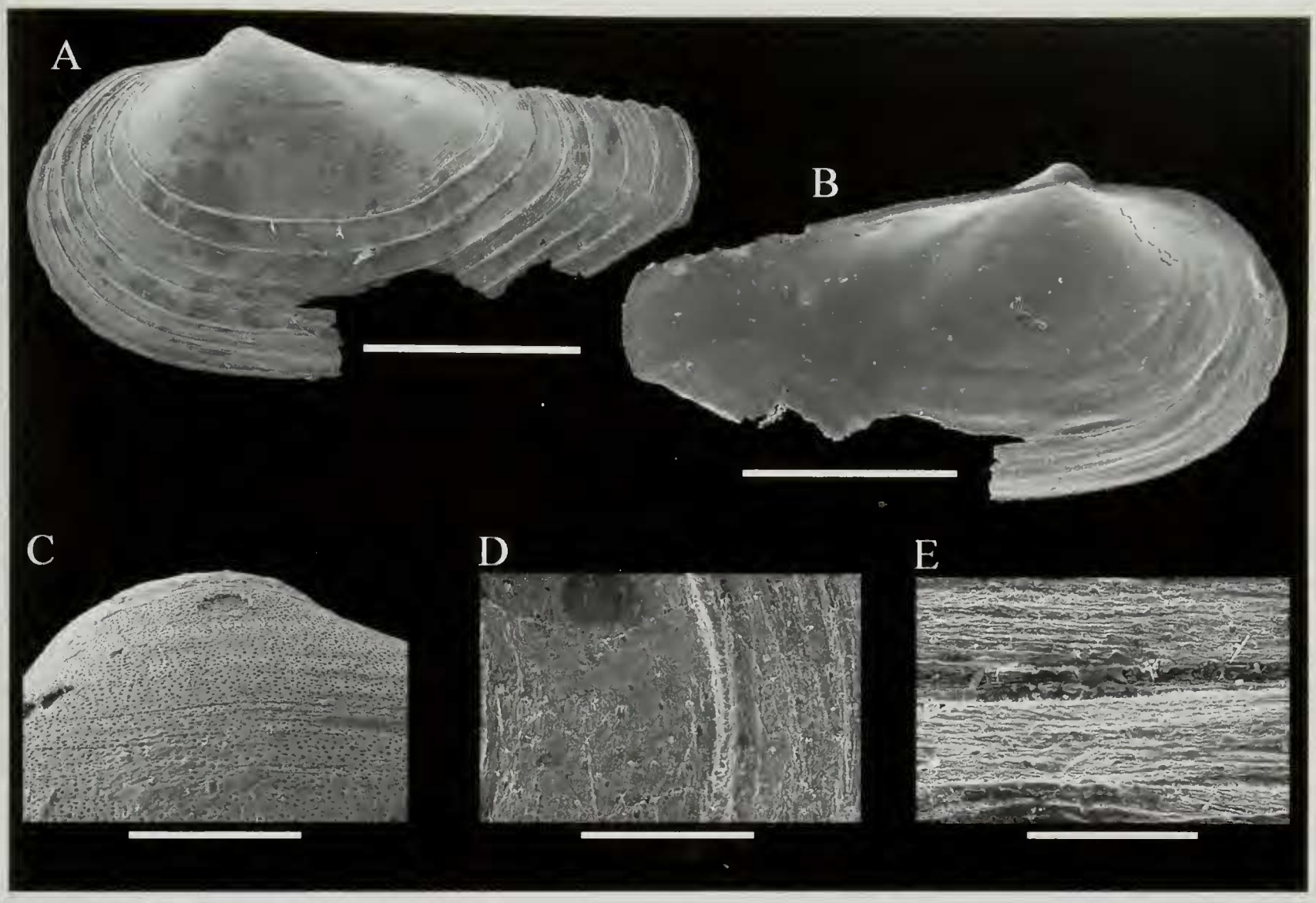

Figure 2. A-E, *Myonera* sp. IBUFRJ 14795. A, external view; B, internal view; C, umbo detail; D, rostrum detail; E, anterior margin detail. Scale bar A-B: 1 mm; C-E: 100 μm.

anterior to the posterior end, including the rostral region (Fig. 2A).

The micro-pits of *Myonera limatula* show an opposite distribution to those of *Myonera* sp. In the former species the micro-pits are present on the umbo but are restricted to the distal margins of the concentric lamellae on the remainder of the shell. In *Myonera* sp. they occur, except on the concentric lamellae, over the umbo region (Fig. 2C) and over the rostrum region (Fig. 2D) vanishing towards the antero-ventral margin (Fig. 2E). Since *Myonera* sp. is a bit smaller than *M. limatula,* such differences in pit distribution might be explained by the intrinsic differences among growth stages, but when one compares the same shell regions of both species it is clear that such differences are not related to growth. In addition, the material of *M. limatula* and *Myonera* sp. is not worn, so such differences cannot be attributed to preservation stage of the shell either.

Myonera kaiwa sp. nov. (Figs. 3A-I)

Description

Shell white, small (max. length 5 mm), elongate, inequilateral, rostrate, inflated. Umbo large, closer to anterior end, rostrum slender, elongate, gently curved dorsally, postero-ventral margin slightly sinuate, anterior margin well rounded. Ornamented with about five concentric foliaceous lamellae, and countless growth lines between them. Rostral ridge present, with a secondary ridge parallel to the dorsal margin usually visible, with growth scars and about seven faint longitudinal striae formed by the periostracum, more conspicuous at the rostrum end. Micro-pits absent on lamellae, but present over entire shell. The micro-pits are more abundant and larger (size: $\bar{x}$ = 10 μm ± 2.8 *SD*) on the rostrum, decreasing in number and in size (size: $\bar{x}$ = 5 μm ± 0.6 *SD*) towards the anterior margin. Hinge edentulous. Resilifer elongate, deflected, posteriorly pointed.

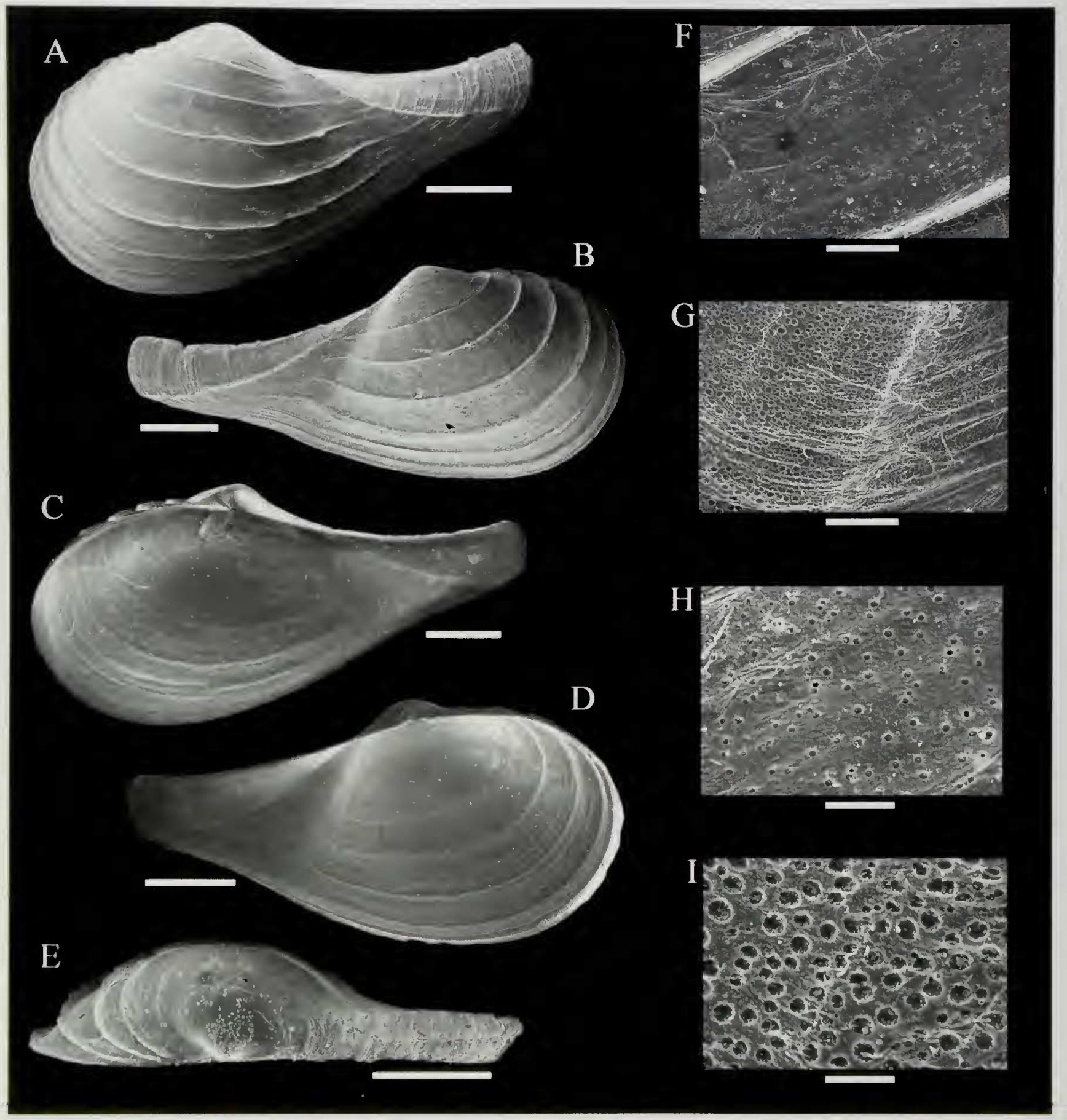

Figure 3. A-I, *Myonera kaiwa* sp. nov. A, external view, left valve. Holotype IBUFRJ 17923; B, external view, right valve. Paratype IBUFRJ 17934; C, internal view, right valve. Paratype IBUFRJ 17933; D, internal view, left valve. Paratype IBUFRJ 17932; E, dorsal view. Paratype IBUFRJ 17886. F-I, Paratype IBUFRJ 14799. F, anterior margin; G, rostrum detail; H, anterior margin detail; I, rostrum detail. Scale bar A-E: 1 mm; F-G: 100 μm; H-I: 40 μm.

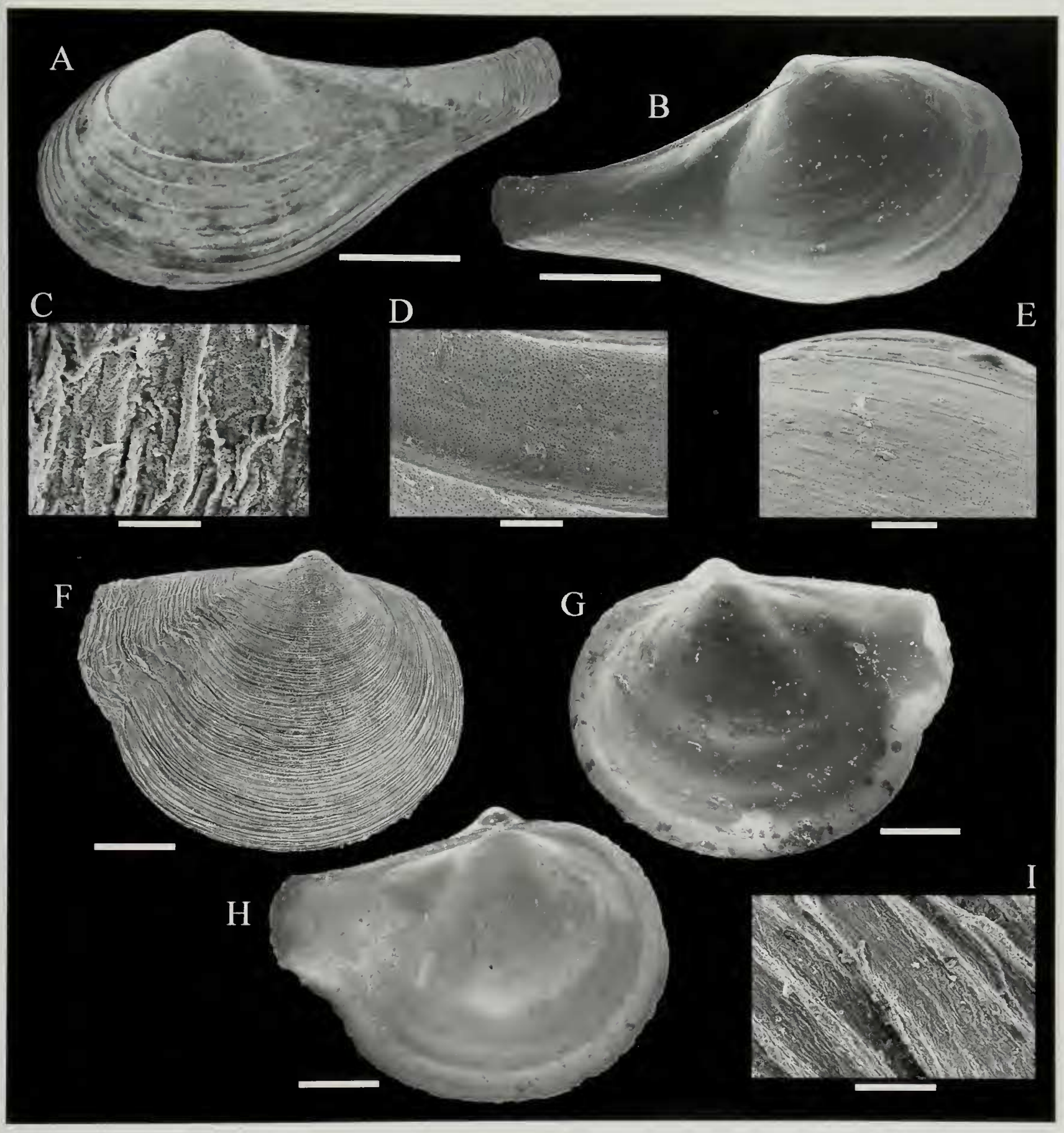

Figure 4. A-E, *Octoporia octaporosa* (Allen and Morgan, 1981). A-B, IBUFRJ 14805. A, external view; B, internal view; C, rostrum detail. IBUFRJ 14802; D, anterior margin detail. IBUFRJ 14800; E, umbo detail. IBUFRJ 14804. F-I, *Protocuspidaria verityi* Allen and Morgan, 1981. F-G, I, IBUFRJ 14998. F, external view; G, internal view, right valve; H, internal view, left valve. IBUFRJ 17896; I, anterior margin detail. Scale bar A-B: 1 mm; C, E: 25 μm; D, I: 50 μm; F-H: 500 μm.

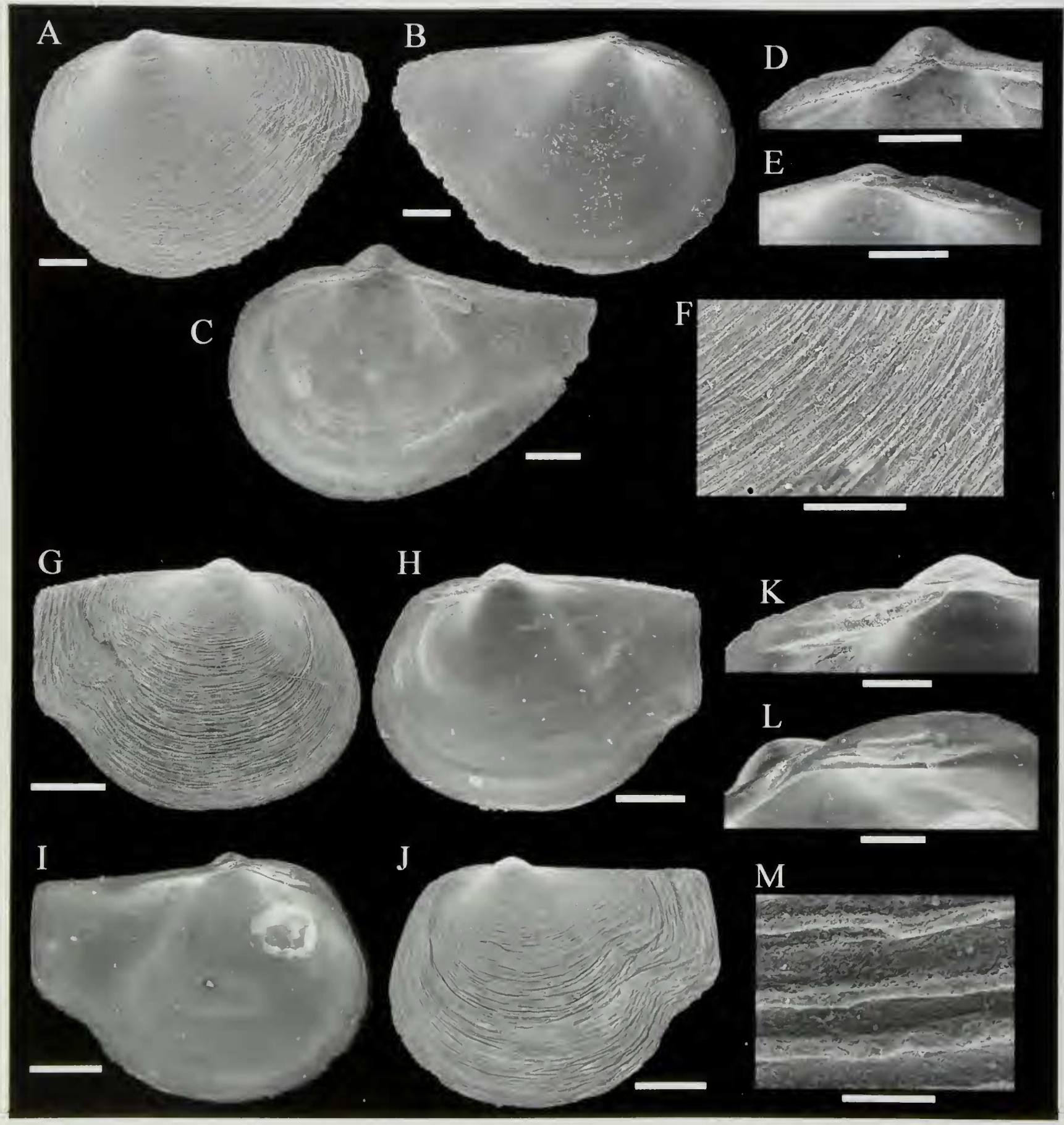

Figure 5. A-F, *Protocuspidaria atlantica* Allen and Morgan, 1981. A-B, E-F, IBUFRJ 14997. C-D, IBUFRJ 18006. A, external view; B-C, internal view from left and right valves, respectively; D-E, hinge detail; F, anterior margin detail. G-M, *Protocuspidaria juranuara* sp. nov. Holotype IBUFRJ 14996. G, J, external view from right and left valves, respectively; H-I, internal view from right and left valves, respectively; K-L, hinge detail; M, anterior margin detail. Scale bar C-D, G-J: 500 µm; A-B, E, K-L: 200 µm; F, M: 50 µm.

Etymology

This species is named in honor of the Kaiwa Indians, one of the indigenous peoples of Brazil. The name is employed as a noun in apposition.

Distribution

Restricted to Campos Basin, Rio de Janeiro state, Brazil.

Holotype

IBUFRJ 17923 (21°52′41″S, 39°46′17″W, 1650 m), 26.VI.03, [left valve].

Paratypes

IBUFRJ 17934 (21°52′41″S, 39°46′17″W, 1650 m), 26. VI.03, [1 valve], IBUFRJ 17933 (21°52′41″S 39°46′17″W, 1650 m), 26.VI.03, [1 valve], IBUFRJ 17932 (21°52′41″S, 39°46′17″W, 1650 m), 26.VI.03, [1 valve], IBUFRJ 17886 (22°05′11″S, 39°42′40″W, 1930 m), 08.V.02, [1 valve], IBUFRJ 14799 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 valve], MNRJ 12859 (22°36′03″S, 39°57′54″W, 1650 m), 16.XI.02, [2 valves], MZUSP 40595 (22°04′45″S, 39°46′31″W, 1650 m), 27.VI.03, [2 valves], MNHN (22°37′02″S, 39°56′20″W, 1950 m), 13.VI.03, [2 valves], MNHN (22°03′27″S, 39°45′07″W, 1730 m), 08.V.02, [3 valves].

Other material examined

IBUFRJ 17879 · (22°09′10″S, 39°44′50″W, 1930 m), 08.V.02, [15 valves], IBUFRJ 17885 (22°06′52″S, 39°44′13″W, 1930 m), 08.V.02, [6 valves], IBUFRJ 17887 (22°05′11″S, 39°42′40″W, 1930 m), 08.V.02, [7 valves], IBUFRJ 17904 (22°01′16″S, 39°43′44″W, 1950 m), 25.XI.02, [4 valves], IBUFRJ 17909 (22°04′44″S, 39°46′31″W, 1650 m), 24.XI.02, [5 valves], IBUFRJ 17916 (21°57′26″S, 39°40′33″W, 1950 m), 11.XII.02, [6 valves], IBUFRJ 17917 (21°52′44″S, 39°40′45″W, 1950 m), 11.XII.02, [4 valves], IBUFRJ 17940 (21°52′43″S, 39°40′41″W, 1950 m), 26.VI.03, [1 valve], IBUFRJ 17950 (22°41′35″S, 40°00′45″W, 1950 m), 22.XI.02, [5 valves], IBUFRJ 17988 (21°57′26″S, 39°40′34″W, 1950 m), 27.VI.03, [5 valves], IBUFRJ 18000 (22°33′08″S, 39°54′21″W, 1950 m), 15.VI.03, [3 valves], IBUFRJ 18011 (22°41′31″S, 40°00′47″W, 1950 m), 06.XII.03, [7 valves], IBUFRJ 18014 (22°30′34″S, 9°51′44″W, 1950 m), 16.VI.03, [7 valves].

Discussion

The most similar species in the South Atlantic is *Myonera alleni*. *Myonera kaiwa* sp. nov. can be distinguished from *M. alleni*, and also from *Myonera* sp. (this study) by less-marked sinuation on the postero-ventral margin, a more concave postero-dorsal margin, a longer and more slender rostrum, and the concentric foliaceous lamellae extending to the umbo and complete to the rostral ridge (Figs. 3A-B).

Regarding the micro-pits, *Myonera kaiwa* sp. nov. is the only taxon that shows this set of features: pits restricted to the shell (not occurring on the concentric ridges) (Figs. 3F-G), the largest pits and a size gradient (Figs. 3H-I). In the Campos Basin, it was present at 20 of 117 stations where pelecypods occurred.

Genus *Octoporia* Scarlato and Starobogatov, 1983

Type species: *Cuspidaria* (*Myonera*) *octaporosa* Allen and Morgan, 1981 original designation by Scarlato and Starobogatov (1983)

Genus characterization

Shell small, elongate, inequilateral, rostrum long. Sculptured with growth lines and concentric ribs, these more conspicuous on anterior part. Hinge edentulous. Septum with 8-20 pairs of pores. (Adapted from Allen and Morgan 1981, Scarlato and Starobogatov 1983, Poutiers and Bernard 1995).

Discussion

The genus *Octoporia* includes species that resemble the shells of *Myonera* but shows anatomical similarities with *Halonympha* Dall, 1886 (Poutiers and Bernard 1995). The name *Octoporia* was introduced by Scarlato and Starobogatov (1983) as a genus with only one known species, *Cuspidaria* (*Myonera*) *octaporosa* (Allen and Morgan, 1981), in their new family Halonymphidae, which accommodates species with 8-20 pairs of septal pores. Subsequently, Krylova (1994) revised *Octoporia*, describing new species.

Currently, the family Hanonymphidae is not generally recognized [except by Scarlato and Starobogatov (1983) and Krylova (1994)] but the name *Octoporia* was accepted as a genus by Poutiers and Bernard (1995) and as a subgenus of *Halonympha* by Harper *et al.* (2006), in both cases, as a taxonomic category in Cuspidariidae.

Octoporia octaporosa (Allen and Morgan, 1981) (Figs. 4A-E)

Cuspidaria (*Myonera*) *octaporosa* Allen and Morgan, 1981: 476-479, figs. 40-41

Octoporia octaporosa: Scarlato and Starobogatov 1983 translated *in* Poutiers and Bernard 1995: 176; Krylova 1994: 40

Characterization

Shell white, small (max. length 5 mm), elongate, inequilateral, rostrate. Umbo small, triangular, blunt, centralized, postero-dorsal margin concave, rostrum slender, faintly postero-ventral sinuation, anterior margin rounded. Ornamentation varying from almost smooth to covered by five or more slender concentric ribs, usually present from ventral margin to middle of shell. Concentric growth lines may be present over entire shell but are much more conspicuous on rostrum. Rostral ridge slight. Additional irregular radial lines barely

visible on rostrum. Micro-pits equally distributed over entire shell and lamellae, but smaller (size: $\bar{x}$ = 0.5 μm ± 0.1 *SD*) on the umbo and on rostrum and larger on the anterior margin (size: $\bar{x}$ = 1 μm ± 0.6 *SD*). Hinge edentulous. Resilifer not visible in present material.

Distribution of *Octoporia octaporosa* (Allen and Morgan, 1981)

References	Locality	Depth (m)
Allen and Morgan (1981)	Type locality: Atlantis II, sta. 92, 36°20.0′N, 67°56.0′W.	4800
	Other material: 37°24.0′N to 0.0°46.0′S; 69°26.2′W to 29°28.0′W.	3459-5000
Present study	Campos Basin, Rio de Janeiro, Brazil.	900-1950

Material examined

IBUFRJ 17857 (22°03′03″S, 39°50′32″W, 1230 m), 13.V.02, [5 valves], IBUFRJ 17863 (22°06′58″S, 39°48′41″W, 1330 m), 09.V.02, [5 valves], IBUFRJ 17869 (22°03′27″S, 39°45′07″W, 1730 m), 08.V.02, [19 valves], IBUFRJ 17870 (22°05′45″S, 39°45′55″W, 1730 m), 09.V.02, [12 valves], IBUFRJ 17875 (22°08′23″S, 39°46′23″W, 1730 m), 09.V.02, [12 valves], IBUFRJ 17881 (22°09′10″S, 39°44′50″W, 1930 m), 08.V.02, [37 valves], IBUFRJ 17882 (22°06′52″S, 39°44′13″W, 1930 m), 08.V.02, [15 valves], IBUFRJ 17889 (22°05′11″S, 39°42′40″W, 1930 m), 08.V.02, [29 valves], IBUFRJ 17890 (22°38′01″S, 40°17′26″W, 900 m), 18.V.02, [1 valve], IBUFRJ 17895 (22°41′18″S, 40°14′05″W, 1100 m), 15.V.02, [4 valves], IBUFRJ 17900 (22°11′04″S, 39°47′04″W, 1650 m), 25.XI.02, [11 valves], IBUFRJ 17901 (22°11′16″S, 39°43′44″W, 1950 m), 25.XI.02, [14 valves], IBUFRJ 17910 (22°04′44″S, 39°46′31″W, 1650 m), 24.XI.02, [10 valves], IBUFRJ 17907 (22°04′46″S, 39°43′02″W, 1950 m), 24.XI.02, [8 valves], IBUFRJ 17915 (21°57′26″S, 39°40′33″W, 1950 m), 11.XII.02, [13 valves], IBUFRJ 17922 (21°52′41″S, 39°46′17″W, 1650 m), 11.XII.02, [34 valves], IBUFRJ17958 (22°46′59″S, 40°07′49″W, 1650 m), 22.XI.02, [9 valves], IBUFRJ 17981 (22°38′53″S, 40°04′14″W, 1350 m), 23.XI.02, [1 valve], IBUFRJ 18003 (22°41′03″S, 40°02′29″W, 1650 m), 23.XI.02, [23 valves], IBUFRJ 17947 (22°41′35″S, 40°00′45″W, 1950 m), 22.XI.02, [75 valves], IBUFRJ 17985 (22°31′28″S, 40°03′50″W, 1050 m), 19.XI.02, [16 valves], IBUFRJ 17966 (22°36′03″S, 39°57′54″W, 1650 m), 16.XI.02, [7 valves], IBUFRJ 17964 (22°37′02″S, 39°56′20″W, 1950 m), 23.XI.02, [22 valves], IBUFRJ 18021 (22°24′31″S, 39°57′28″W, 1050 m), 20.XI.02, [6 valves], IBUFRJ 17995 (22°27′18″S, 39°54′50″W, 1350 m), 17.XI.02, [2 valves], IBUFRJ 17930 (22°30′35″S, 39°51′45″W, 1950 m), 23.XI.02, [32 valves], IBUFRJ 14800 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 valve], IBUFRJ 14801 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [4 valves], IBUFRJ 14802 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [4 valves], IBUFRJ 14803 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [11 valves], IBUFRJ 14804 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [5 valves], IBUFRJ 14805 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [4 valves], IBUFRJ 14806 (21°57′05″S, 39°49′58″W, 1200 m), 24.IX.2001 [1 valve], IBUFRJ 18022 (22°33′10″S, 39°54′22″W, 1950 m), 23.XI.02, [72 valves], IBUFRJ 17959 (22°10′53″S, 39°52′18″W, 1050 m), 01.VII.03, [4 valves], IBUFRJ 17978 (22°11′04″S, 39°47′04″W, 1650), 22.VI.03, [10 valves], IBUFRJ 17990 (22°11′16″S, 39°43′44″W, 1950 m), 22.VI.03, [18 valves], IBUFRJ 18024 (22°04′33″S, 39°52′05″W, 1050 m), 30.VI.03, [2 valves], IBUFRJ 18023 (22°04′43″S, 39°49′09″W, 1350 m), 25.VI.03, [1 valve], IBUFRJ 17953 (22°04′45″S, 39°46′31″W, 1650 m), 27.VI.03, [2 valves], IBUFRJ 17996 (22°04′45″S, 39°41′58″W, 1950 m), 27.VI.03, [15 valves], IBUFRJ 17938 (21°57′15″S, 39°47′41″W, 1650 m), 28.VI.03, [7 valves], IBUFRJ 17989 (21°57′26″S, 39°40′34″W, 1950 m), 27.VI.03, [29 valves], IBUFRJ 18012 (21°52′51″S, 39°48′12″W, 1350 m), 26.VI.03, [2 valves], IBUFRJ 17931 (21°52′41″S, 39°46′17″W, 1650 m), 26.VI.03, [27 valves], IBUFRJ 17939 (21°52′43″S, 39°40′41″W, 1950 m), 26.VI.03, [56 valves], IBUFRJ 17974 (22°48′05″S, 40°06′38″W, 1950 m), 06.XII.03, [25 valves], IBUFRJ 17926 (22°41′10″S, 40°02′20″W, 1650 m), 13.VI.03, [6 valves], IBUFRJ 18004 (22°34′05″S, 40°00′12″W, 1350 m), 15.VI.03, [2 valves], IBUFRJ 17946 (22°36′12″S, 39°58′22″W, 1650 m), 13.VI.03, [16 valves], IBUFRJ 18007 (22°28′46″S, 39°53′27″W, 1650 m), 17.VI.03, [8 valves], IBUFRJ 17977 (22°31′37″S, 39°55′14″W, 1650 m), 16.VI.03, [2 valves], MNHN (22°31′28″S, 40°03′49″W, 1050 m), 18.VI.03, [17 valves].

Discussion

This species may show variation in rostrum shape and features of ornamentation. The elongated rostrum is normally concave, pointing dorsally (Figs. 4A-B) but some specimens show the rostrum almost straight. The shell ornamentation grades from almost smooth to about 9 concentric ribs. We suspect that the shell illustrated by Poutiers (1984: 291, fig. 4) as *Cuspidaria* sp. is in fact *Octoporia octaporosa*, but only direct examination of this shell could resolve this matter.

This species exhibits a simple pattern of distribution of micro-pits. Though smaller on rostrum (Fig. 4C) and on the lamellae, specifically on the distal ends (Fig. 4D), the micro-pits are dispersed over the entire shell (Figs. 4C-E). Since there is no information about micro-pits on *Octoporia* spp. and because *Octoporia octaporosa* is the only species of the genus *Octoporia* studied herein, it is not possible to compare this pattern of distribution of micro-pits with other congeneric species. This species was quite abundant

in our samples (743 valves), and in the Campos Basin it was present at 49 of 117 stations where pelecypods occurred.

Genus *Protocuspidaria* Allen and Morgan, 1981
Type species: *Protocuspidaria verityi* Allen and Morgan, 1981 by original designation in Allen and Morgan (1981)

Genus characterization

Shell small, rounded, equivalve, inequilateral, rostrate, laterally compressed. Umbo small, hemispherical, closer to anterior end. Rostrum very short, with variable width. Postero-ventral sinuation with individual variation, anterior margin rounded, and postero-dorsal margin nearly straight. Shell surface covered by countless striae, more conspicuous toward ventral margin and rostrum. Hinge edentulous, or with anterior lateral tooth on one or both valves. Resilifer small, central. Septum thin, membranous, with no muscle attachments to the shell (Adapted from Allen and Morgan 1981, Krylova 1995, Poutiers and Bernard 1995).

Discussion

This genus poses a great challenge, in part because, as pointed out by Allen and Morgan (1981: 495), "All species have a similar external appearance, in that they are small, rounded, laterally flattened with a very short rostrum", and still according to Allen and Morgan (1981: 500), "there is sufficient variation between individuals to make identification other than by reference to dentition extremely difficult."

The genus *Protocuspidaria* was established by Allen and Morgan (1981), with species showing quite variable outlines. Three subgenera are characterized by the presence or absence of hinge teeth, or by which valve bears the teeth. Accordingly, the subgenus *Protocuspidaria* is characterized by an anterior tooth only on the right valve, the subgenus *Edentaria* Allen and Morgan, 1981 is characterized by a hinge devoid of teeth on both valves, and the subgenus *Bidentaria* Allen and Morgan, 1981 is characterized by an anterior tooth on both valves (Allen and Morgan 1981: 495, 497, and 499, respectively). Poutiers and Bernard (1995) stated that this subgeneric division does not represent this group in a realistic way. According to them, this scheme of separation based on the hinge structure fails to distinguish each group, but in spite of that they keep the subgeneric division proposed by Allen and Morgan (1981).

Scarlato and Starobogatov (1983) proposed the superfamily Protocuspidarioidea and the family Protocuspidariidae, with each subgenus of Allen and Morgan (1981) raised to genus level. Subsequently, Poutiers (1984: 295, fig. 6a-b) described *Protocuspidaria* (*Edentaria*) *thomassini* and Krylova (1995) added 10 new species but recognized the family Protocuspidariidae with only two genera: *Protocuspidaria* (with three subgenera: *Protocuspidaria*, *Bidentaria*, and *Edentaria*) diagnosed by the presence of 7 tentacles on the siphon border and *Multitentaculata* Krylova, 1995 that shows between 7 and 33 tentacles on the siphon border. Besides that, Krylova (1995) subdivided *Multitentaculata* according to the hinge. The subgenus *Multitentaculata s.s.* lacks teeth, whereas the subgenus *Dentaria* would be characterized by the presence of an anterior lateral tooth on the right valve. According to Krylova (1995: 34) "the tentacles number at siphon border is, at time, the unique distinguishing morphological character between the subgenus *Protocuspidaria* and *Multitentaculata*." At the same time, Poutiers and Bernard (1995) and Morton (2003: 378, table 3) did not recognizes the family Protocuspidariidae.

Because there are intense discussions about the phylogeny of Septibranchia (Dreyer *et al.* 2003, Harper *et al.* 2006) and because of the lack of taxonomic evidence to maintain the higher-rank level of *Protocuspidaria*, we prefer to follow the authors that retain *Protocuspidaria* at the genus level (*e.g.*, Allen and Morgan 1981, Poutiers and Bernard 1995) although some divisions may prove to be useful in the future. Micro-pits were absent in all species examined herein.

Protocuspidaria (*Protocuspidaria*) *verityi* Allen and Morgan, 1981 (Figs. 4F-I)
Protocuspidaria (*P.*) *verityi* Allen and Morgan, 1981: 496-497, figs. 61-62; Krylova, 1995: 31.

Characterization

Shell white, small (max. recorded length 5 mm), rounded, inequilateral, rostrate. Umbo small, closer to anterior end. Anterior margin rounded, usually giving rise to a plateau immediately next to the umbo. Rostrum truncate, usually short, variable in height. Postero-ventral sinuation with individual variation. Dorsal margin straight. Shell surface covered by countless striae. Micro-pits absent. Hinge with anterior lateral tooth only on right valve. Resilifer small, central.

Distribution of *Protocuspidaria (Protocuspidaria) verityi* Allen and Morgan, 1981

References	Locality	Depth (m)
Allen and Morgan (1981)	Type locality: Atlantis II, sta. 167, 7°58.0′S, 34°17.0′W to 7°50.0′S, 34°17.0′W.	943-1007
	Other material: 47°35.5′N to 36°05.2′S; 11°35.0′E to 68° 31.0′W.	943-4706
Present study	Campos Basin, Rio de Janeiro, Brazil.	750-1950

Material examined

IBUFRJ 17854 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.01, [1 valve], IBUFRJ 17859 (22°07′17″S, 39°50′02″W, 1230 m), 13.V.02, [5 valves], IBUFRJ 17861 (22°06′58″S, 39°48′41″W, 1330 m), 09.V.02, [3 valves], IBUFRJ 17873 (22°05′45″S, 39°45′55″W, 1730 m), 09.V.02, [4 valves], IBUFRJ 17878 (22°09′10″S, 39°44′50″W, 1930 m), 08.V.02, [2 valves], IBUFRJ 17893 (22°33′31″S, 40°12′05″W, 900 m), 18.V.02, [2 valves], IBUFRJ 17896 (22°39′34″S, 40°08′22″W, 1200 m), 15.V.02, [1 valve], IBUFRJ 17897 (22°10′54″S, 39°52′19″W, 1050 m), 10.XII.02, [7 valves], IBUFRJ 17902 (22°11′16″S, 39°43′44″W, 1950 m), 25.XI.02, [3 valves], IBUFRJ 17905 (22°04′43″S, 39°49′08″W, 1350 m), 24.XI.02, [1 valve], IBUFRJ 17906 (22°04′46″S, 39°43′02″W, 1950 m), 24.XI.02, [2 valves], IBUFRJ 17918 (21°52′44″S, 39°40′45″W, 1950 m), 11.XII.02, [3 valves], IBUFRJ 17941 (21°52′43″S, 39°40′41″W, 1950 m), 26.VI.03, [2 valves], IBUFRJ 18019 (22°27′31″S, 40°09′23″W, 750 m), 18.VI.03, [3 valves], IBUFRJ 17944 (22°36′12″S, 39°58′22″W, 1650 m), 13.VI.03, [1 valve], IBUFRJ 17956 (22°46′59″S, 40°07′49″W, 1650 m), 22.XI.02, [4 valves], IBUFRJ 17962 (22°10′53″S, 39°52′18″W, 1050 m), 01.VII.03, [1 valve], IBUFRJ 17980 (22°11′04″S, 39°47′04″W, 1650 m), 22.VI.03, [1 valve], IBUFRJ 17963 (22°37′02″S, 39°56′20″W, 1950 m), 23.XI.02, [2 valves], IBUFRJ 17969 (22°28′49″S, 39°53′24″W, 1650 m), 17.XI.02, [1 valve], IBUFRJ 17968 (22°36′03″S, 39°57′54″W, 1650 m), 16.XI.02, [1 valve], IBUFRJ 17982 (22°38′53″S, 40°04′14″W, 1350 m), 23.XI.02, [3 valves], IBUFRJ 17991 (22°11′16″S, 39°43′44″W, 1950 m), 22.VI.03, [1 valve], IBUFRJ 17992 (22°29′33″S, 39°56′17″W, 1350 m), 19.XI.02, [1 valve], IBUFRJ 17997 (22°04′45″S, 39°41′58″W, 1950 m), 27.VI.03, [2 valves], IBUFRJ 17998 (22°37′02″S, 39°56′20″W, 1950 m), 13.VI.03, [2 valves], IBUFRJ 18001 (22°33′08″S, 39°54′21″W, 1950 m), 15.VI.03, [2 valves], IBUFRJ 18016 (22°26′28″S, 39°54′08″W, 1350 m), 21.VI.03, [1 valve], IBUFRJ 18017 (22°24′30″S, 39°57′28″W, 1050 m), 20.VI.03, [2 valves], IBUFRJ 18018 (22°35′04″S, 40°08′53″W, 1050 m), 21.XI.02, [2 valves], IBUFRJ 18020 (21°52′59″S, 39°55′32″W, 750 m), 29.VI.03, [1 valve], IBUFRJ 17949 (22°41′35″S, 40°00′45″W, 1950 m), 22.XI.02, [2 valves], IBUFRJ 17874 (22°08′23″S, 39°46′23″W, 1730 m), 09.V.02, [1 valve], IBUFRJ 17884 (22°06′52″S, 39°44′13″W, 1930 m), 08.V.02, [3 valves], IBUFRJ 17986 (22°31′28″S, 40°03′50″W, 1050 m), 19.XI.02, [4 valves], MNHN (22°03′03″S, 39°50′32″W, 1230 m), 13.V.02, [2 valves].

Discussion

Despite the many individuals examined, no specimen showed micro-pits on any part of the shell (Fig. 4I). Since we cannot find micro-pits at any other *Protocuspidaria* species studied herein, we suppose that the absence of micro-pits might be a character of the generic level. In the Campos Basin it was present at 36 of 117 stations where pelecypods occurred.

Protocuspidaria (Bidentaria) atlantica Allen and Morgan, 1981 (Figs. 5A-F)

Protocuspidaria (*B.*) *atlantica* Allen and Morgan, 1981: 499, figs. 64-67; Krylova, 1995: 33

Characterization

Shell white, small (max. recorded length 5 mm), rounded, inequilateral, rostrate. Umbo small, hemispherical, closer to anterior end. Anterior margin rounded, usually giving rise to a plateau immediately next to the umbo. Rostrum truncate, variable in height. Postero-ventral sinuation with individual variation, from almost inconspicuous to quite accentuated. Dorsal margin straight. Shell surface covered by countless striae. Micro-pits absent. Hinge with anterior lateral tooth on both valves. Resilifer small, central.

Distribution of *Protocuspidaria (Bidentaria) atlantica* Allen and Morgan, 1981

References	Locality	Depth (m)
Allen and Morgan (1981)	Type locality: Discovery, sta. 6696, 28°6.0′N, 13°28.0′W.	1780
	Other material: 46°31.2′N to 28°06.0′N; 66°47.0′W to 10°19.5′W.	1150-4706
Present study	Campos Basin, Rio de Janeiro, Brazil.	900-1950

Material examined

IBUFRJ 14997 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [5 valves], IBUFRJ 14998 (21°57′05″S, 39°49′58″W, 1200 m), 24.IX.2001 [4 valves], IBUFRJ 17858 (22°05′04″S, 39°50′01″W, 1230 m), 09.V.02, [4 valves], IBUFRJ 17864 (22°04′52″S, 39°49′04″W, 1330 m), 09.V.02, [2 valves], IBUFRJ 17891 (22°38′01″S, 40°17′26″W, 900 m), 18.V.02, [2 valves], IBUFRJ 17894 (22°37′54″S, 40°13′36″W, 1000 m), 19.V.02, [3 valves], IBUFRJ 17921 (21°52′41″S, 39°46′17″W, 1650 m), 11.XII.02, [3 valves], IBUFRJ 17928 (22°41′10″S, 40°02′20″W, 1650 m), 13.VI.03, [2 valves], IBUFRJ 17929 (22°30′35″S, 39°51′45″W, 1950 m), 23.XI.02, [1 valve], IBUFRJ 17937 (21°57′15″S, 39°47′41″W, 1650 m), 28.VI.03, [2 valves], IBUFRJ 17945 (22°36′12″S, 39°58′22″W, 1650 m), 13.VI.03, [1 valve], IBUFRJ 17961 (22°10′53″S, 39°52′18″W, 1050 m), 01.VII.03, [7 valves], IBUFRJ 17965 (22°37′02″S, 39°56′20″W, 1950 m), 23.XI.02, [1 valve], IBUFRJ 17970 (22°28′49″S, 39°53′24″W, 1650 m), 17.XI.02, [1 valve], IBUFRJ 17973 (22°48′05″S, 40°06′38″W, 1950 m), 06.XII.03, [3 valves], IBUFRJ 17975 (22°31′37″S, 39°55′14″W, 1650 m), 16.VI.03, [3 valves], IBUFRJ 17983 (22°38′53″S, 40°04′14″W, 1350 m),

23.XI.02, [3 valves], IBUFRJ 17984 (22°31′28″S, 40°03′50″W, 1050 m), 19.XI.02, [2 valves], IBUFRJ 17987 (21°57′26″S, 39°40′34″W, 1950 m), 27.VI.03, [2 valves], IBUFRJ 17993 (22°29′33″S, 39°56′17″W, 1350 m), 19.XI.02, [3 valves], IBUFRJ 17994 (22°27′18″S, 39°54′50″W, 1350 m), 17.XI.02, [3 valves], IBUFRJ 18002 (22°41′03″S, 40°02′29″W, 1650 m), 23.XI.02, [3 valves], IBUFRJ 18005 (22°34′05″S, 40°00′12″W, 1350 m), 15.VI.03, [1 valve], IBUFRJ 18006 (22°28′46″S, 39°53′27″W, 1650 m), 17.VI.03, [1 valve], IBUFRJ 18009 (22°31′28″S, 40°03′49″W, 1050 m), 18.VI.03, [8 valves], IBUFRJ 18013 (21°52′51″S, 39°48′12″W, 1350 m), 26.VI.03, [4 valves], IBUFRJ 18015 (21°52′51″S, 39°48′11″W, 1350 m), 12.XII.02, [5 valves], MNHN (22°41′31″S, 40°00′47″W, 1950 m), 06.XII.03, [2 valves].

Discussion

This species shows the most variable outline and teeth variation in shape, but the presence of the anterior lateral teeth in both valves is diagnostic (Figs. 5D-E). These teeth can vary in their degree of development according to the size of the specimen (*e.g.*, Allen and Morgan 1981, Poutiers and Bernard 1995), but this kind of variation, or expression, lacks taxonomic significance. Like all other species of this genus, no micro-pits were observed, even at high magnification (Fig. 5F). In the Campos Basin, it was present at 28 of 117 stations where pelecypods occurred.

Protocuspidaria (*Bidentaria*) *jarauara* sp. nov. (Figs. 5G-M)
Myonera aff. *ruginosa auct. non* Jeffreys, 1881: Absalão *et al.*, 2003: 327, figs. 10-11

Description

Shell white, small (max. recorded length 5 mm), rounded, inequilateral, rostrate, laterally compressed. Umbo small, closer to anterior end. Anterior margin rounded, an anterior plateau present immediately next to the umbo. Rostrum large, truncate. Ventral and dorsal margins of the rostrum subparallel. Shell surface covered by countless striae. Micro-pits absent. Hinge with bifid anterior lateral tooth on both valves. Resilifer small, central.

Etymology

This species is named in honor of the Jarauara Indians, one of the indigenous peoples of Brazil. The name is employed as a noun in apposition.

Distribution

Restricted to Campos Basin, Rio de Janeiro state, Brazil.

Holotype

IBUFRJ 14996 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 spec.].

Paratype

IBUFRJ 17888 (22°05′11″S, 39°42′40″W, 1930 m), 08.V.02, [2 valves], MNRJ 12860 (22°10′54″S, 39°48′59″W, 1350 m), 25.VI.03, [2 valves], MZUSP 40957 (22°04′45″S, 39°46′31″W, 1650 m), 27.VI.03, [2 valves], MNHN (22°10′55″S, 39°49′00″W, 1350 m), 10.XII.02, [2 valves], MNHN (21°52′44″S, 39°40′45″W, 1950 m), 11.XII.02, [2 valves].

Other material examined

IBUFRJ 17862 (22°06′58″S, 39°48′41″W, 1330 m), 09.V.02, [1 valve], IBUFRJ 17872 (22°05′45″S, 39°45′55″W, 1730 m), 09.V.02, [4 valves], IBUFRJ 17876 (22°08′23″S, 39°46′23″W, 1730 m), 09.V.02, [1 valve], IBUFRJ 17877 (22°09′10″S, 39°44′50″W, 1930 m), 08.V.02, [1 valve], IBUFRJ 17883 (22°06′52″S, 39°44′13″W, 1930 m), 08.V.02, [5 valves], IBUFRJ 17892 (22°38′01″S, 40°17′26″W, 900 m), 18.V.02, [1 valve], IBUFRJ 17898 (22°10′55″S, 39°49′00″W, 1350 m), 10.XII.02, [1 valve], IBUFRJ 17903 (22°11′16″S, 39°43′44″W, 1950 m), 25.XI.02, [1 valve], IBUFRJ 17908 (22°04′46″S, 39°43′02″W, 1950 m), 24.XI.02, [1 valve], IBUFRJ 17913 (21°57′15″S, 39°47′43″W, 1650 m), 14.XII.02, [1 valve], IBUFRJ 17914 (21°57′26″S, 39°40′33″W, 1950 m), 11.XII.02, [1 valve], IBUFRJ 17920 (21°52′41″S, 39°46′17″W, 1650 m), 11.XII.02, [1 valve], IBUFRJ 17927 (22°41′10″S, 40°02′20″W, 1650 m), 13.VI.03, [1 valve], IBUFRJ 17942 (21°52′43″S, 39°40′41″W, 1950 m), 26.VI.03, [2 valves], IBUFRJ 17943 (22°36′12″S, 39°58′22″W, 1650 m), 13.VI.03, [1 valve], IBUFRJ 17948 (22°41′35″S, 40°00′45″W, 1950 m), 22.XI.02, [1 valve], IBUFRJ 17955 (22°46′59″S, 40°07′49″W, 1650 m), 22.XI.02, [1 valve], IBUFRJ 17957 (22°46′59″S, 40°07′49″W, 1650 m), 22.XI.02, [3 valves], IBUFRJ 17960 (22°10′53″S, 39°52′18″W, 1050 m), 01.VII.03, [2 valves], IBUFRJ 17971 (22°28′49″S, 39°53′24″W, 1650 m), 17.XI.02, [3 valves], IBUFRJ 17972 (22°48′05″S, 40°06′38″W, 1950 m), 06.XII.03, [1 valve], IBUFRJ 17976 (22°31′37″S, 39°55′14″W, 1650 m), 16.VI.03, [4 valves], IBUFRJ 18028 (22°31′36″S, 39°55′15″W, 1650 m), 16.XI.02, [1 valve], IBUFRJ 18061 (21°58′36″S, 39°46′30″W, 1700 m), 08.X.2001 [1 valve].

Discussion

The diagnostic character of this species is a bifid anterior lateral tooth on both valves (Figs. 5K-L), since this bifid tooth is absent in all other species previously reported in the genus. The presence of this tooth could suggest that a fourth subgenus is present—and still unnamed—if one used exclusively hinge characters to determine the subgenera of *Protocuspidaria*. But, because we do not have any other information about soft parts or any other kind of data beyond the conchological one, we prefer to keep the new species in *Bidentaria*.

Exteriorly, *Protocuspidaria* (*Bidentaria*) *jarauara* sp. nov. could be initially confused with *Protocuspidaria* (*Bidentaria*)

atlantica and *Protocuspidaria* (*Protocuspidaria*) *verityi*, but the hinge differences clearly distinguish the three species.

Absalão *et al.* (2003: 327) has previously assigned *Protocuspidaria* (*Bidentaria*) *jaranara* sp. nov. to the Brazilian coast under the name *Myonera* aff. *ruginosa* Jeffreys, 1881. In fact, the description of the genus *Protocuspidaria* is very similar to the description given for *Myonera ruginosa* Jeffreys (1881: 942, pl. LXXI, fig. 7), which distinguishes *M. ruginosa* by the external surface of the shell covered by narrow concentric striae, a short and truncated rostrum, anterior border rounded, a small prominent umbo, and an anterior tooth on the left valve. So, the identification of *M. ruginosa* to Brazil must be disregarded. The transfer of *M. ruginosa* to the genus *Protocuspidaria* was first suggested by Allen and Morgan (1981: 995) and followed by Krylova (1995: 29).

No micro-pits were observed, even at high magnification (Fig. 5M). In the Campos Basin it was present at 29 of 117 stations where pelecypods occurred.

GENERAL DISCUSSION

Reflecting the difficulties involved in collecting material from deep waters, and despite the efforts of several investigators over the past 30 years (Allen and Turner 1974, Allen and Morgan 1981, Leal and Simone 2000, Absalão *et al.* 2001, 2003, 2005, Simone 2002, 2003, Absalão and Pimenta 2003, 2005, Absalão and Santos 2004, Caetano *et al.* 2006, Simone and Cunha 2006, Zelaya *et al.* 2006, Barros *et al.* 2007, Lima and Barros 2007), the Brazilian deep-water species are essentially unknown. Most (five of eight) of the species reported here were not previously recorded in Brazilian waters. Two species are new to science (*Myonera kaiwa* sp. nov. and *Protocuspidaria jaranara* sp. nov.) and for one taxon, *Myonera* sp., a formal epithet will be delayed until additional material is available. Except for *Myonera paucistriata*, which is probably the most common of all septibranchs at Campos Basin, all others species studied herein have their known range expanded geographically and/or bathymetrically. *Protocuspidaria verityi* though well represented at North Atlantic Ocean, has been scarcely represented at South Atlantic Ocean, with an occurrence gap between the latitudinal coordinates 09° and 36°S. *Myonera limatula* and *Protocuspidaria atlantica* are for the first time recorded in the South Atlantic Ocean and Brazil. *Octoporia octaporosa* had been previously recorded for the South Atlantic Ocean, but we have enlarged its range to the south. Bathymetrically, *O. octaporosa* (900 m), *P. verityi* (750 m), and *P. atlantica* (900 m) show their shallowest record, while *M. limatula* (1700 m) shows its deepest record. These new data show that our understanding of the taxonomic composition and distribution of deep-water pelecypod species inhabiting Brazilian coast is still unsatisfactory.

Under high resolution of a Scanning Electron Microscope (SEM), a character not yet reported for septibranchs was observed: the presence of micro-pits on the shell surface. The distribution of micro-pits found on the species studied here is not random and seems to be a taxonomically useful pattern.

Only the type species of *Octoporia*, *O. octaporosa*, is represented in our samples. This is numerically the most abundant species sampled and, in spite of the variation in the shell ornamentation, which grades from almost smooth to concentrically ribbed, all specimens show the same pattern of distribution of the micro-pits. On *Protocuspidaria*, despite the many individuals and the three species examined in this paper, no micro-pits were observed on any part of the shell. These findings suggest the importance of the micro-pits for taxonomic proposals. For the genus *Myonera*, only the genus type species, *M. paucistriata*, has no micro-pits. The other species studied herein (four taxa) exhibit, each one, a different pattern of distribution of the micro-pits on the shell surface and additional research is needed to establish the potential use of such micro-pits in this taxonomic category.

The micro-pits resembles the "pores" described for polyplacophorans that house the aesthetes and have been observed in other molluscs [*e.g.*, according to Reindl and Haszprunar (1996), in Polyplacophora, *Leptochiton cancellatus* (Sowerby, 1839); Gastropoda, *Diodora graeca* (Linnaeus, 1758); and Pelecypoda, *Arca noae* Linnaeus, 1758)]. The homology of these pits is not established and their probable function is a matter for speculation, with widely differing interpretations. Some authors have suggested that their function is sensory (Baxter *et al.* 1990), or for excretion (Waller 1980), or for maintenance of the periostracum (Baxter *et al.* 1987). The function of such micro-pits for septibranchs is thus still unclear and open to future research.

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